Setting the Energy Baseline For Performance Contracts

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ABSTRACT

Measurement and verification for performance contracting is necessary to verify the achieved savings. In some cases, verified savings is required in order to repay the capital investment for the project. One very key, but often overlooked element is the establishment of the baseline to be used. In a lot of performance contracting projects, actual construction of the energy project becomes paramount to all parties, and baseline becomes a neglected or secondary element. Since the project typically requires replacement of old, inefficient equipment, establishment of a baseline after completion of the project is virtually impossible. This article will discuss the importance of properly establishing a baseline for PC projects, including acceptance by all parties.

Performance contracting has played a major role in energy management projects for several years now. These projects have necessitated the task of verifying the energy savings. This has lead to an industry devoted to the measurement and verification (M&V) of these savings. An important function of this M&V function is the establishment of the baseline that will be used to verify the savings.

Unfortunately, there are too many instances where establishment of the baseline is done almost as an afterthought, sometimes very late into project implementation, or even after completion, or not at all.

This action, or lack of action, jeopardizes the success of the project. This author believes adamantly that ***baselines should be established and approved prior to the implementation of the project***.

WHAT IS THE "BASELINE?"

The baseline for an energy performance contract is simply that value of energy consumption that would have occurred if the project was not accomplished. Energy savings then become the difference between the baseline and actual energy consumption after implementation of the project. One thing though that this author has learned in performance contracting, there is nothing simple about it. This most specifically includes the establishment of a baseline.

Performance contract projects are between two or more parties. Typically, the project includes the facility owner and the energy service company. The project may also involve a financing company who is putting up the money for the project.

Another party may also be the utility, especially if funding from demand-side management programs is included, All the parties must then agree to the baseline. The baseline that is agreed to must represent a binding agreement on all parties for the life of the contract, not subject to a unilateral change by any one party alone.

Unfortunately, time to complete the project is usually foremost in all parties' agenda.

The facility owner usually wants to begin seeing the results of the project, that is energy savings, immediately, if not sooner.

The energy services company wants to have the project completed quickly so that they can gain full financial benefits of the project.

The lender wants to see the project completed so that his loan is repaid as soon as possible.

And the utility wishes to have completed projects in their DSM portfolio to show the success of the program

Regrettably, this rush to complete a project sometimes results in not thoroughly setting the baseline properly. This results in the baseline being set after the fact. There are two dangerous fall-outs to such actions. *First*, as stated previously, the baseline should be a binding agreement, not subjected to any changes. *Second*, if the baseline is being developed after construction has commenced, all physical evi-

dence of equipment that is being replaced could be removed and destroyed. It is extremely difficult to establish a baseline on equipment that is no longer in place or in existence. Compromises in setting the baseline may result, which will probably not be very favorable to the project nor to any party involved in the project.

THE IMPORTANCE OF THE BASELINE

To understand why it is important to properly set the baseline in a timely fashion, you must understand how the baseline fits into the performance aspects of a performance contract. A performance contract project relies on the results of the project to not only determine how successful the project is, but also to determine a revenue stream which finances the project.

Energy savings from the project can throw off a revenue stream from two potential sources. First and foremost, there will be a reduction in energy consumption at the facility. This reduction will result in lower than normal utility bills, resulting in more money remaining in the facility's "pocket." If the utility has a DSM program, a second revenue stream can be gained from utility rebates or payments based on the energy savings.

In order to determine the energy savings, actual consumption from the performance contract is subtracted from the baseline, an estimate of what energy consumption would have been if the project had not been installed. The savings realized by the performance contract thus is highly dependent on where the baseline has been set. Properly setting the baseline at its correct level is quite important in determining the energy savings that will be achieved.

In the previous section, I emphasized the point that setting the baseline should be a binding agreement by all parties. This point cannot be overemphasized. I have personally seen many performance contract projects jeopardized because the baseline was not established in a timely fashion, allowing for one or more parties to adjust the baseline after the fact.

Usually, when there are disputes regarding baselines, it revolves around accusations that they have been set too high. If the baseline is lowered, energy savings realized from the project will likewise be

lowered. Disputes revolving around baselines and energy savings then impact actual dollar amounts that are supposedly "saved," and such disputes influence the payback of the loans affecting both the financing company and potentially the energy service company.

Another adverse effect is also the perception of the success of the project. If anticipated energy savings are not realized, the perceived success of the project is lowered. The facility owner as well as the energy services company then end up with a damaged reputation.

Failure to obtain a binding agreement of the baseline prior to commencement is also an indication of the lack of proper planning of the project. After all if the baseline is a moving or unset target, how can anticipated savings be estimated to justify the project in the first place?

THIS CANNOT BE SAID TOO OFTEN: It is important to set the baseline prior to the start of any performance contract project, and savings estimated at that time. It cannot be overstated that this MUST be done first.

METHODOLOGIES FOR ESTABLISHING BASELINES

There are four methods which can be employed to establish the baseline: (1) stipulation, (2) standardized tables, (3) manufacturer's specifications, and (4) actual measurement.

Stipulation is actually the simplest method. It also results in the lowest risk exposure to all parties. In this method, all parties agree ahead of implementation of the baseline. This agreement is usually based on engineering judgments and/or calculations.

In some instances, standardized tables may be utilized. The "Measurement Protocol For Commercial Industrial and Residential Facilities" was prepared in context for the implementation of New Jersey's demand-side management rules and is a good example of standardized tables. In this document are numerous tables which define "Default Values" for setting baselines. This document has its place in establishing baseline values.

The third source of data for establishing baselines is from infor-

mation from manufacturers. This data can be obtained from specification sheets, test results, or certified performance equipment records.

The fourth source is from taking actual measurements of the baseline equipment as it is operating in the field prior to removal or modification as part of the energy project. The biggest drawback with this method of establishing baselines is its timeliness and cost. Usually, extended data collection time periods are required. This, of course, will increase the cost to implement the project.

All methods described in this section are acceptable, as long as all parties agree to its use. Cost should not be the determining factor in which method is selected; however, it obviously does play a part in the overall project. The key here is to select the most cost effective method which gives all parties an acceptable level of confidence that the baseline has been properly set.

EXAMPLES OF SETTING BASELINES

The following examples of how to set baselines is the result of years of experience in setting baselines by the author.

Lighting Retrofits

Lighting retrofits were very common performance contract projects that were accomplished within the past decade or so. Improvements in lamps and electronic ballasts and the simplicity in retrofitting lighting fixtures, led to many projects. Usually establishment of baseline is a simple manner. An audit of existing equipment is undertaken, and a wattage per fixture is determined. Wattage can be determined from standardized tables or from measurements. This author has used both methods in the past.

Determining wattage for each fixture from tables is relatively simple. There are tables that have been developed by the lighting industry which gives wattage draw for combinations of different lamps and ballast combinations. These tables have been universally accepted by most parties involved with performance contracting.

The author has used measurement of actual wattage of fixtures to determine the baseline. In all honesty, the results were very close to the table values, so close in fact to result in a conclusion that such measurement activities are not worth the additional cost.

If lighting retrofits are so easy to establish a baseline, why worry at all about setting a baseline? Because, though the wattage of the fixtures is usually not the issue, the quantity and type of fixtures are. Lighting retrofits should have audits that are used to establish the baseline.

Additionally, these audits should be verified that they are correct by all parties involved, and thus accepted as a baseline. Once construction begins and lighting equipment removed and destroyed, it becomes impossible to verify the accuracy of the baseline.

Equipment Replacements

Another common energy performance contract project is the replacement of old, inefficient equipment such as air conditioning equipment with new, high efficiency equipment. The project may also involve fuel switching as well. An example of this is the replacement of an electric chiller with a gas-fired absorber.

Determining proper baselines for such retrofits represents quite the challenge for all parties involved. For example, suppose that an older inefficient HVAC is to be replaced. The best method to set a baseline is to obtain actual energy data for an entire cooling season, that is, actual measurements. This would involve measuring the cooling load from the unit against electrical consumption during a cooling season. Obviously, this approach has a serious drawback in that the time involved to collect such data is lengthy and may not be practical.

As an alternative, manufacturer's data for the unit, if available, can be utilized. This information can be gleaned from nameplate data, if they are still on the machines and are readable, or possibly from historical data files either at the manufacture or the facility itself. From experience, the older the unit, the harder it is to obtain nameplate or historical information.

Another approach is to use standardized tables that have been adopted for setting baselines. The previously mentioned "Measurement Protocol For Commercial Industrial and Residential Facilities" is one source for standardized tables. The problem with such tables is that they are a "one size fits all" approach, which really is not the ideal solution. It may however, be the only solution that is available.

Process Projects

These projects are usually unique in that process improvements may be standard only to those sites alone. In order to establish baseline for energy performance contracts for such projects, pre-implementation data must be taken. Usually, the length of such data collection varies based on what the analysis of data shows. For example, if it is believed that pre-implementation data is constant, usually 30 days of data will support this assumption.

One project was a process improvement which varied air flow to the process after the retrofit was completed. Prior to implementation, it was believed that air flow was a constant. This was verified with the collection of approximately 45 days of data, which indeed showed a constant electrical consumption. The baseline was accepted at this constant level and savings were determined by subtracting the post-implementation actual energy measurements from the baseline.

If in this case, pre-implementation electrical consumption was not constant, then further determinations would have been required to determined the factors that affected and varied electrical consumption. This can be an extremely time-consuming and costly effort, but one that would have been required for the successful implementation of the project.

CONCLUSIONS

Performance contracting requires that the energy savings be verifiable. This is important to all parties—to the owner that he has a successful project and is achieving provable savings, to the energy services company, and to the energy company who depends on the revenue stream to repay construction loans. Additionally, if the project is part of a utility-funded demand-side management program, it is important to the utility to prove energy savings.

In order to measure and verify energy savings, a baseline, agreed to by all parties, must be established prior to project implementation. If the project is allowed to proceed without the baseline being established and approved, the project could well turn into a financial disaster.

There are four methods identified to establish the baseline:

stipulation, standardized tables, manufacturer's information, or actual measurements. All have their advantages and disadvantages as well as cost factors. The method selected depends on the type of project, the total cost and anticipated savings of the project, and the comfort level of all parties involved.

The most important issue that must be addressed in establishing a baseline is that it MUST be done prior to project implementation and it MUST be binding to all parties throughout the life of the project.

ABOUT THE AUTHOR

Martin A. Mozzo Jr. is president of M&A Associates, Inc. M&A Associates provides energy engineering and consulting services to retail, commercial and industrial end users as well as energy service companies. Prior to starting M&A Associates Inc., Mr. Mozzo worked for Energy Performance Services, Inc. and KENETECH Energy Management, Inc., both nationally prominent energy service companies. Prior to that, Mr. Mozzo worked for 17 years at American Standard Inc., in a number of positions including corporate director of energy management.

Mr. Mozzo has been very active in the Association of Energy Engineers. He is currently past president of AEE, having served as president during 1999. He currently serves as chairman of two of AEE's certification boards, the Certified Lighting Efficiency Professional (CLEP) and the Certified GeoExchange Designer (CGD) Boards. He is a senior charter member of AEE, was Region I vice president (national) for two years, was executive vice president, and was a board of director member for the New Jersey chapter for several years. Mr. Mozzo was elected into the AEE Energy Managers Hall of Fame in 1995.

Mr. Mozzo holds a BS in mechanical engineering from Rutgers University, an MS in logistics management from the Air Force Institute of Technology, Dayton, Ohio, and is a registered PE in the states of New Jersey, New York, Pennsylvania, and Ohio. He has received certification as a CEM and CLEP from AEE.

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